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Human capital, technical change and the welfare state

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HUMAN CAPITAL, TECHNICAL CHANGE, AND THE WELFARE STATE

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Abstract

I study the interactions between the distribution of human capital, technological choice, and redistributive institutions. I first ask what makes alternative social contracts such as a European-style "welfare state" and US-style "laissez-faire" sustainable, and in particular how each is affected by skill-biased technical change. I then endogenize technological or organizational choice, and show that firms respond to greater human capital heterogeneity with more flexible technologies that further exacerbate wage equality. I then analyze the simultaneous determination of technology, income distribution, and redistributive institutions, and as well as spillovers between the social contracts of different countries.

JEL classification: D31, O33, J3, H10.

Keywords: inequality, welfare state, technical change, skill bias, human capital, redistribution, social contract.

Contents

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1. Introduction[1]

In this paper I examine the interactions between income inequality, technological choice, and redistributive policies or institutions. This research, which is developed more fully in Bénabou (2002), brings together two main sets of issues. The first one concerns the political economy of redistribution: why is the social contract –taxes and transfers, unemployment and health insurance, education finance, and labor market regulation– so different across countries with similar economic and political fundamentals, such as the United States and Europe? In particular, what makes the Welfare State sustainable, and what shocks might cause it to unravel?[2] The second theme is that of technological change and wage inequality. Over the last 20 years, many countries have experienced a significant rise in wage inequality –particularly the United States and Great-Britain, which also have some of the more "laissez-faire" social contracts. This rise in inequality is usually attributed to three main factors: skill-biased technical change, international trade (about which I shall have nothing to say), and institutional change, such as the decline of unions and the erosion of minimum wage.[3] The latter, however, are largely endogenous policy outcomes, and indeed evolved quite differently in Continental Europe (or Canada) compared to the United States. Conversely, it has been argued that the skill bias in technological and organizational innovations is itself endogenous, responding in particular to changes in the distribution of skills.[4]

In what follows I present a simple model of human capital accumulation, technology choice and redistributive policy, in which all three are potentially interdependent, and use it to study the set of questions raised above. I seek in particular to identify the main mechanisms that allow different societal forms to perpetuate themselves, as well as the forces pushing toward convergence.

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1 This paper was prepared for the session on "The Dynamics of the Welfare State" of the Annual Congress of the European Economic Association, Venice, August 2002. Email: rbenabou@princeton.edu

2 See, e.g., Bénabou (2000), Saint Paul (2001) and Hassler et al. (2002), who also examine the impact of technical change.

3 See, e.g., Freeman (1995), Fortin and Lemieux (1997), Lee (1999).

4 See, e.g., Kremer and Maskin (1996), Acemoglu (1998), (2002), Kiley (1999), Lloyd-Ellis (1999), Thesmar and Thoenig (2000), and Vindigini (2002). Relatedly, Grossman and Maggi (2000) show how the skill distribution matters for international specialization, and Legros and Newman (1996) how the wealth distribution affects the organization of firms.

2. Inequality and the Social Contract

My starting point is the politico-economic model in Bénabou (2000), based on imperfections in asset markets (for credit and insurance) and in the political system (the influence of wealth). There is a continuum $i \in [0,1]$ of overlapping generations. Adults produce output, using their own human capital k_t^i and effort l_t^i, and subject to i.i.d. productivity shocks z_t^i :

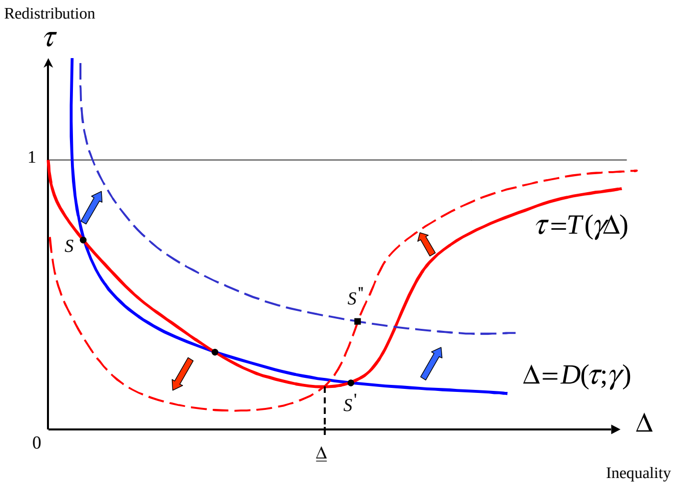
(1) $$y_t^i = z_t^i \left(k_t^i\right)^{\gamma} \left(l_t^i\right)^{\delta}.$$

Later on I shall introduce a richer production structure, where agents with different skill levels perform complementary tasks and the degree of substitutability between them may be optimally chosen by firms. Adults care about their own consumption, leisure, and the (expected) human capital of their children. The latter is determined by the accumulation technology

(2) $$k_{t+1}^i = \kappa\, \xi_{t+1}^i\, (k_t^i)^{\alpha}\, (e_t^i)^{\beta},$$

where ξ_{t+1}^i represents random ability and e_t^i is educational investment. There is no loan market for human capital, and no insurance market where the (lognormally distributed) risks z_t^i and ξ_{t+1}^i could be diversified away. In every period, before the productivity shocks z_t^i are realized, adults collectively determine, through the political process, a rate of redistribution $\tau_t \leq 1$ to which they will be subject. This τ_t may represent progressivity in taxes and transfers, in education finance, or in wage policy. Since, empirically, rich agents have more political influence than poor ones (higher propensities to vote, lobby, make campaign contributions, etc.), I allow the rank of the *pivotal voter* in the income distribution to be some $p^* \geq 50\%$. Equivalently, I measure the degree of wealth-bias in the political system by $\lambda \equiv \Phi^{-1}(p^*) \geq 0$, where $\Phi(\cdot)$ denotes the c.d.f. of a standard normal.

The essence of the model can now be summarized by *two key relationships* between inequality and redistribution. These are illustrated by the solid lines in Figure 1, where the horizontal axis measures the variance Δ of log-human capital, and the vertical axis the degree of redistribution τ.



1.The two key relationships between inequality and redistribution (solid lines), and the effects of an increase in the returns to human capital (dashed lines).

• *From inequality to redistribution.* In each period, the equilibrium policy is a U-shaped function $\tau_t = T(\gamma\Delta_t)$ of income inequality. The crucial downward-sloping part reflects the incompleteness of asset markets, which implies that redistribution helps provide insurance and relax the credit constraints impeding investment. When distributional conflict $\gamma\Delta_t$ is small enough relative to these *ex-ante welfare gains* (net of tax distortions), there is widespread support for redistributive policies, resulting in a high equilibrium τ_t. As inequality rises, however, so does the fraction of agents rich enough to oppose such policies, and this forces down the equilibrium level of τ_t. At very high levels of inequality, finally, the standard skewness effect eventually dominates: beyond $\underline{\Delta}$ rising numbers of poor impose increasing levels of redistribution, whether efficient or inefficient. Another intuitive property of the policy-outcome locus $T(\cdot)$ is that it shifts down when the degree of wealth-bias in the political system, λ, increases.

• *From redistribution to inequality.* The downward-sloping curve $\Delta = D(\tau;\gamma)$ reflects the intergenerational transmission mechanism. Due to the credit constraints bearing on poorer agents, the law of motion for human capital inequality is of the form $\Delta_{t+1} = \mathtt{D}(\Delta_t, \tau_t; \gamma)$, with $\mathtt{D}$ increasing in parental background disparities Δ_t and decreasing in the rate of fiscal or educational redistribution τ_t. Thus, in the long-run (steady-state), human wealth inequality declines with redistribution, as indicated by the locus $\Delta = D(\tau;\gamma)$ in Figure 1.

This simple graph makes clear that the two loci can have several intersections, resulting in multiple (stable) politico-economic steady-states. It also suggests (and I establish in Bénabou (2000)) the specific conditions under which this occurs:

(a) the ex–ante welfare *benefits* of redistribution must be high enough, relative to the costs. Otherwise, the range over which the $T(\cdot)$ locus is declining will be too narrow to allow for multiple intersections.

(b) the political *power* of the wealthy must lie in some intermediate range. If λ is too large (too small), $T(\cdot)$ will be shifted down too low (up too high) resulting in a unique equilibrium with high inequality and low redistribution (or vice-versa).

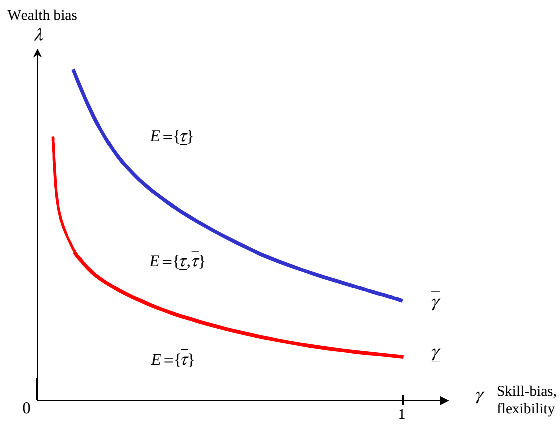
The model can thus account for the coexistence of a generous "Welfare State" in certain countries and a much more "Laissez-Faire" social contract in others that have similar economic and political fundamentals. Moreover, it predicts a *negative* correlation between inequality and redistribution across them –as one indeed observes between the United States and Europe, and among OECD countries in general (Pineda and Rodriguez (2000)). It also offers a natural role for *historical events:* temporary shocks to the distribution of wealth (immigration, educational discrimination) or the political system (slavery, voting rights restrictions) can permanently move society to a different path. For instance, the model provides an intuitive formalization of the thesis of Engerman and Sokoloff (1998), who point to different initial conditions in terms of inequality (Δ_0) and the concentration of power (λ_0) as the key factors that set South and North America on a very different development courses.

One can also show that either of the two social contracts (which are never Pareto-rankable) can result in faster long-run growth, depending on the tradeoff between tax distortions and the productivity gains from reallocating investments (e.g., education health) towards poorer, more credit–constrained agents.

3. Technology and Redistributive Institutions

3.1 *Skill-Biased Technical Change and the Viability of the Welfare State*

I now examine the role of technology in determining which social contracts are sustainable in the long run. As illustrated by the dashed lines in Figure 1, skill-biased technical change –an exogenous increase in γ– affects both of the key curves in the model. The intergenerational-transmission locus $\Delta = D(\tau; \gamma)$ shifts up: for any given τ and initial



2.Technology, political influence, and the social contract; $\bar{\tau}$ = "Welfare State", $\underline{\tau}$ = "Laissez Faire".

Δ_t there is more inequality in incomes, hence also in investments, and consequently more inequality of human capital in the long run. As to the policy locus $\tau = T(\gamma\Delta)$, it shifts down over $[0, \underline{\Delta})$ and up over $(\underline{\Delta}, +\infty)$: since what matters for the political outcome is *income* inequality $\gamma\Delta$, an increase in γ for given Δ has the same U-shaped effect on τ as an increase in Δ for given γ.

Figure 1 suggests that a rise in the return to skill can have, in the long run, very drastic consequences for redistributive institutions: starting from a situation with multiple steady-states, an increase in γ tends to undermine the sustainability of the "Welfare State" equilibrium. Similarly, starting from a configuration with a single "Welfare-State" it can make a second, "Laissez-Faire" equilibrium appear. To simplify the formal analysis, I shall restrict voters to a choice between *two policies:*[5]

- a generous "Welfare State" social contract, corresponding to a high rate of redistribution $\bar{\tau} \in (0, 1)$;

- a more "Laissez Faire" social contract, corresponding to a low rate of redistribution $\underline{\tau} \in (0, \bar{\tau})$.

Proposition 1 *There exist two thresholds* $\underline{\gamma}(\lambda) < \bar{\gamma}(\lambda) < 1$, *both decreasing in* λ, *such that:*

i) for $\gamma < \underline{\gamma}(\lambda)$, *the unique steady-state is* $(\bar{\tau}, D(\bar{\tau}; \gamma))$;

[5] I also abstract from labor supply distortions, and impose additional technical conditions; see Bénabou (2002).

ii) for $\gamma \in \left[\underline{\gamma}(\lambda), \bar{\gamma}(\lambda)\right]$*, both* $(\bar{\tau}, D(\bar{\tau};\gamma))$ *and* $(\underline{\tau}, D(\underline{\tau};\gamma))$ *are steady-states;*

iii) for $\gamma > \bar{\gamma}(\lambda)$*,* $(\underline{\tau}, D(\underline{\tau};\gamma))$ *is the unique steady-state.*

As illustrated in Figure 2, these results confirm that the Welfare State *becomes unsustainable* when technology becomes too skill-biased, and that multiple social contracts can coexist only when γ is in some intermediate range. They also reveal an interesting interaction between the production and political "technologies". For instance, in a country with relatively little wealth-bias, the welfare state is –for better of for worse– much more "immune" to skill-biased technical change than in one where λ is higher. Similarly, a given change in the political system will have very different effects on redistributive institutions, depending on how skill-biased the technology is.

3.2 *Endogenous Technological and Organizational Flexibility*

I now consider the reverse mechanism, namely how inequality itself feeds back onto the nature of technical change, making γ *endogenous.* Recognizing that individuals do not produce in isolation, I formalize production interactions using a simple specialization structure, similar to that in Bénabou (1996). Final output is produced by competitive firms, using a continuum of differentiated inputs or tasks:

(3) $$y_t = A_t \cdot \left(\int_0^\infty z_t(s) \cdot x_t(s)^{\frac{\sigma-1}{\sigma}}\, ds\right)^{\frac{\sigma}{\sigma-1}},\ \sigma \geq 1,$$

where $x_t(s)$ denotes the quantity of input s, $z_t(s)$ an i.i.d. sectoral shock, and A_t a TFP parameter. Workers specialize in a single task; facing downward-sloping demand curves, each chooses a different one, $s(i) = i$, and produces $x_t^i = k_t^i\, l_t^i$ units. Simple calculations yield the corresponding input price p_t^i, hourly wage $\omega_t^i = p_t^i\, k_t^i$, and income

(4) $$y_t^i = \omega_t^i\, l_t = A_t^{\frac{\sigma-1}{\sigma}} \cdot (y_t)^{\frac{1}{\sigma}} \cdot \left[z_t^i \cdot \left(k_t^i\right)^{\frac{\sigma-1}{\sigma}} l_t^i\right] \equiv \tilde{A}_t \cdot z_t^i \cdot \left(k_t^i\right)^{\gamma} (l_t^i)^{\delta}.$$

This is just as in the earlier model, with $\gamma \equiv (\sigma-1)/\sigma$ and $\delta = 1$, except for the productivity factor $\tilde{A}_t \equiv A_t^{\frac{\sigma-1}{\sigma}} (y_t)^{\frac{1}{\sigma}}$, which workers and voters take as given. The distributional dynamics and political equilibrium thus remain essentially unchanged, and so do the corresponding $D(\tau;\gamma)$ and $T(\gamma\Delta)$ loci.

Consider now firms. In equilibrium, all workers supply the same effort $l_t^i = l_t$, and the distribution of human capital remains lognormal, $\ln k_t^i \sim \mathcal{N}(m_t, \Delta_t^2)$. The output of a representative firm is thus:

$$y_t = A_t \cdot l_t \cdot \left(\int_0^1 \left(k_t^i \right)^{\frac{\sigma-1}{\sigma}} di \right)^{\frac{\sigma}{\sigma-1}} = A_t \cdot l_t \cdot e^{-\Delta_t^2/2\sigma} \cdot \left(\int_0^1 k_t^i \, di \right). \tag{5}$$

Keeping average human capital constant, the loss $e^{-\Delta_t^2/2\sigma}$ makes apparent the productivity costs imposed by (excessive) *heterogeneity of the labor force:* poorly educated, insufficiently skilled production and clerical workers will drag down the productivity of engineers, managers and scientists (and vice-versa). We also see that a production technology with *greater substitutability* between the tasks performed by different types of workers reduces the costs of labor force heterogeneity (Bénabou (1996), Grossman and Maggi (2000)). Indeed, this greater *flexibility* allows firms to more easily substitute towards the more productive workers. In the process, of course, wage inequality rises: Var$[\ln y_t^i] = (\frac{\sigma_t - 1}{\sigma_t})^2 \Delta_t^2 = \gamma_t^2 \Delta_t^2$. One can also think of a higher σ as a more discriminating search technology, resulting in more assortative matching between workers –that is, in a more *segregated* production structure (Kremer and Maskin (1996)).

I now model firms' decisions with respect to the degree of flexibility in their technology or organizational form. Abstracting from the intertemporal (investment) aspects of technological innovations, I simply assume that firms can choose from a menu of available technologies, with *different elasticities of substitution* $\sigma \in [1, +\infty)$ and costs $c(\sigma)$; the latter result in a TFP factor $A(\sigma) = e^{-c(\sigma)}$, with $c' > 0$ and $c'' > 0$. Given the distribution of workers' human capital (m_t, Δ_t^2) and the technology σ_t used by other firms, each one chooses its own technology $\hat{\sigma}$ as a best response.

Proposition 2 *There is a unique symmetric equilibrium in technological choice. The more heterogenous the workforce, the more flexible and inegalitarian the technology used by firms:* $\sigma_t = \sigma^*(\Delta_t)$, *with* $0 < \partial \ln \sigma^* / \partial \ln \Delta < 1$.

This result has several interesting implications. First, the return to human capital $\partial \ln y / \partial \ln k = (\sigma^* - 1)/\sigma^*$ is higher, ceteris paribus, where the labor force is more heterogenous –further magnifying the effects of educational disparities. Second, firms' choice of technology involves a *dynamic externality* that tends to result in an *excessively skill-biased* or flexible technology: each takes the distribution of human capital it faces as given, but neglects the effects of its own flexibility on workers' human capital investments, and therefore on subsequent distributions. A lower σ_t would reduce current income inequality $\gamma_t\Delta_t$, which is growth-enhancing given the presence of credit constraints. This would in turn lower the skill disparities Δ_{t+k} that firms will face in the future, as well as the costs $c\,(\sigma^*(\Delta_{t+k}))$ they will bear to adapt to this heterogeneity. Although $\gamma_t = (\sigma_t - 1)/\sigma_t$ also affects in a somewhat complex way the concavity of educational investment, it is easy to identify cases (e.g., $\alpha = 0, \beta = 1$) where growth in every period would be higher if firms collectively chose less skill-biased technologies.

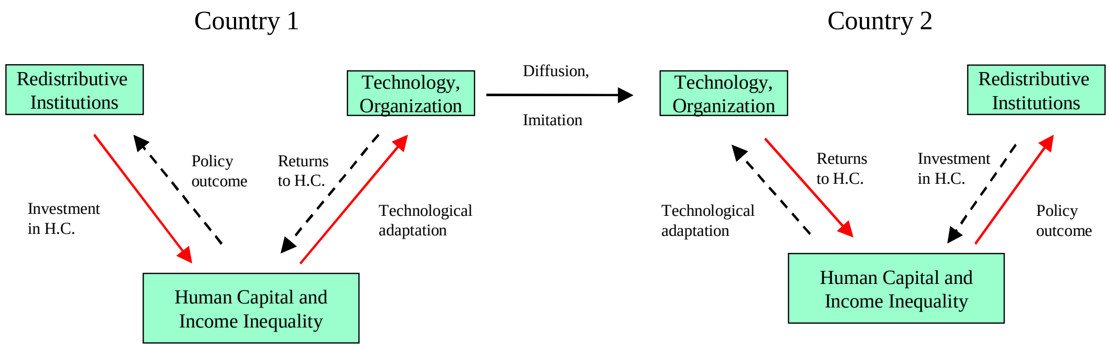
We now have a model with *endogenous institutions* and *endogenous technology.* Denoting $\Gamma(\Delta) \equiv (\sigma^*(\Delta) - 1)/\sigma^*(\Delta)$, the dynamical system governing the economy's evolution becomes

(6) $$\Delta_{t+1} = \mathcal{D}(\Delta_t, \tau_t; \gamma_t) = \mathcal{D}(\Delta_t, T(\Gamma(\Delta_t)\Delta_t); \Gamma(\Delta_t)).$$

This makes clear the presence of important *multiplier effects:* a transitory shock affecting inequality (e.g., more idiosyncratic uncertainty) or the political system (e.g., a higher λ) will be amplified through technological decisions, the policy choice, and the intergenerational transmission mechanism, and may thus have drastic long-term effects. Most importantly, in accounting for changes in inequality one can no longer treat *technological* and *institutional* factors as separate, competing explanations: both are *jointly* determined, and complementary. The model thus shows how, in the words of Freeman (1995), one needs to think of "the Welfare State as a system".

To demonstrate these points more concretely, I shall assume from here on a piecewise-linear technological frontier: the function $c\,(\sigma)$ is flat up to σ_L (that much flexibility is "free"), then has a slope of $M > 0$ up to $\sigma_H > \sigma_L$ (maximum flexibility), at which point it becomes vertical. The analogue of Proposition in this case is very simple: the unique technological outcome is $\sigma_t = \sigma_L$ when $\Delta_t^2/2M < \sigma_L^2$, and $\sigma_t = \sigma_H$ when $\Delta_t^2/2M > \sigma_H^2$; when $\Delta_t^2/2M \in (\sigma_L^2, \sigma_H^2)$ firms mix between σ_L and σ_H, in proportions such that the resulting factor prices make each one indifferent.

Consider now two countries, C_1 and C_2, that are identical in all respects, including both using the technology σ_L, except that one is in a laissez-faire equilibrium, the other in



3.International spillovers between social contracts

a welfare state. Suppose now that the technological frontier gradually flattens (M declines), meaning that flexibility becomes cheaper to achieve. An intuitive result is that the laissez-faire country will be the "early adopter" of the more inegalitarian technology. That is, there is a range $[M', M'']$ in which nothing happens in C_2, while in C_1 the more skill-biased technology σ_H first becomes another feasible equilibrium, and ultimately the only one. Only when M falls below M' does a similar transition become feasible, an ultimately inevitable, in C_2. This result may help explain why skill-biased technological changed occurred first, and to a greater extent, in the United States compared to Europe. It also makes apparent the *reciprocal interactions* between technology and policy: feasible new technologies are not implemented unless institutions are (or become) sufficiently inegalitarian; conversely, the occurrence of technological change alters these same institutions.

3.3 *Exporting Inequality: Spillovers Between Social Contracts*

The model naturally leads us to think about spillovers between national policies or institutions, via technological diffusion. The basic idea is illustrated in Figure 3, which shows how the social contract in Country 2 can, in the long-run, be affected by technological or even purely political shifts in Country 1, propagated along the channels indicated by solid lines on the diagram.

The formal analysis is developed in Bénabou (2002), using the above-described model and the additional assumption that the marginal cost of adapting or copying a more flexible technology, once it has been developed and implemented in another country, is only $m < M$. This lower cost may for instance reflect, as in Acemoglu (1998), an imperfect international enforcement of property rights over technological or organizational innovations.

I shall discuss here only one scenario, namely *the transmission of a political shock.* Having seen earlier how the mere fact of being in different steady states (say, for historical reasons) can lead to very different technological trajectories, I shall assume here that C_1 and C_2 both start in the egalitarian steady-state, $(\bar{\tau}, \gamma_L, D(\bar{\tau}, \gamma_L))$, with the same technology σ_L. Let C_1 now experience an increase in the political influence of wealth, λ. This may reflect a rising importance of *lobbying and campaign contributions,* an exogenous *decline in unionization,* or a lower *electoral turnout* by the poor. As a result of such a shift, redistribution (fiscal and/or educational) in country C_1 declines. This leads over time to a rise in human capital inequality, to which firms respond by adopting more flexible (and wage-disequalizing) technologies, switching from γ_L to $\gamma_{H.}$ Those in C_2, which would not have developed such technologies by themselves, now find it profitable to copy them from C_1. This results in a rise in income inequality in C_2, and ultimately leads to the unravelling of the Welfare State in that country as well. Thus, the unique long run outcome is for *both countries* to switch to the more skill-biased technology σ_H *and* the more unequal social contract $\underline{\tau}$, ending up at the steady-state $(\underline{\tau}, \gamma_H, D(\underline{\tau}; \gamma_H))$.

4. Conclusion

The work described here identifies important politico-economic mechanisms that allow alternative societal models to perpetuate themselves, as well as some powerful forces that push towards uniformization. Among the latter is skill-biased technical change, which can potentially lead to the unravelling of the Welfare State. When technological or organizational form is endogenous, moreover, firms respond to greater human capital heterogeneity with more flexible technologies, further exacerbating income inequality. On the other hand, the possibility for firms in different countries to chose technologies adapted to the local labor force can make it easier to sustain multiple social models. The international diffusion of technology, however, implies that more flexible and skill-biased technologies profitably developed in countries with more unequal social contracts may then be imitated by firms in other countries, thereby triggering a “chain reaction” that, again, pushes the whole system towards an outcome that is more inegalitarian –technologically, economically, and politically speaking. Such international spillovers between national social contracts are key to the debate over globalization, and warrant further research.

References

Acemoglu, D. (1998) "Why Do New Technologies Complement Skills? Directed Technical Change and Inequality," *Quarterly Journal of Economics* 113(4), 1055-1090.

____________ (2002) "Directed Technical Change," *Review of Economic Studies*, 69(4), 781-809.

Bénabou, R. (1996) "Heterogeneity, Stratification, and Growth: Macroeconomic Implications of Community Structure and School Finance," *American Economic Review*, 86(3), 584–609.

____________ (2000) "Unequal Societies: Income Distribution and the Social Contract," *American Economic Review*, 90(1), 96–129.

____________ (2002) "Inequality, Technology, and the Social Contract," Princeton University mimeo, July 2002.

Engerman, S. and Sokoloff, K. (1997) "Factor Endowments, Institutions, and Differential Growth Paths among New World Economies," in S. Haber ed., "*How Latin America Fell Behind: Essays on the Economic Histories of Brazil and Mexico, 1800-1914,*" Stanford University Press, 260-304.

Fortin, N. and Lemieux, T. (1997) "Institutional Changes and Rising Wage Inequality: Is There A Linkage?, *Journal of Economic Perspectives*, 11(2), 75-97.

Freeman, R. (1995) "The Large Welfare State as a System," *American Economic Review Papers and Proceedings*, 85(2), 16-21.

Grossman, G. and Maggi, G. (2000) "Diversity and Trade," *American Economic Review*, 90(5), 1255-1275.

Hassler J., Rodriguez–Mora, J., Storesletten, K. and Zillibotti, F. (2003) "The Survival of the Welfare State", *American Economic Review*, forthcoming.

Kiley, M. (1999) "The Supply of Skilled Labor and Skill-Biased Technological Progress," *Economic Journal*, 109(458), 708-724.

Kremer, M. and Maskin, E. (1996) "Wage Inequality and Segregation by Skill," NBER Working Paper 5718.

Lee, D. (1999) "Wage Inequality in the United States during the 1980s: Rising Dispersion or Falling Minimum Wage?", *Quarterly Journal of Economics*, 114(3), 977–1023.

Lloyd-Ellis, H. (1999) "Endogenous Technological Change and Inequality," *American Economic Review,* 89(1), 47-77.

Legros, P. and Newman A. (1996) "Wealth Effects, Distribution, and the Theory of Organization," *Journal of Economic Theory,* 70(2), 312-341.

Pineda, J. and Rodriguez, F. (2000) "The Political Economy of Human Capital Accumulation," University of Maryland at College Park, mimeo, February.

Saint-Paul, G. (2001) "The Dynamics of Exclusion and Fiscal Conservatism," *Review of Economic Dynamics,* 4(2), 275-302.

Thesmar, D. and Thoenig, M. (2000) "Creative Destruction and Firm Organizational Choice," *Quarterly Journal of Economics*, 115(4), 1201-1239.

Vindigini, A. (2002a) "Income Distribution and Skilled-Biased Technical Change," Université de Toulouse Ph.D. Dissertation, Chapter 2, June.

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L. GUISO and G. PARIGI, *Investment and demand uncertainty*, Quarterly Journal of Economics, Vol. 114 (1), pp. 185-228, **TD No. 289 (November 1996)**.

A. CUKIERMAN and F. LIPPI, *Central bank independence, centralization of wage bargaining, inflation and unemployment: theory and evidence*, European Economic Review, Vol. 43 (7), pp. 1395-1434, **TD No. 332 (April 1998)**.

P. CASELLI and R. RINALDI, *La politica fiscale nei paesi dell'Unione europea negli anni novanta,* Studi e note di economia, (1), pp. 71-109, **TD No. 334 (July 1998)**.

A. BRANDOLINI, *The distribution of personal income in post-war Italy: Source description, data quality, and the time pattern of income inequality*, Giornale degli economisti e Annali di economia, Vol. 58 (2), pp. 183-239, **TD No. 350 (April 1999)**.

L. GUISO, A. K. KASHYAP, F. PANETTA and D. TERLIZZESE, *Will a common European monetary policy have asymmetric effects?*, Economic Perspectives, Federal Reserve Bank of Chicago, Vol. 23 (4), pp. 56-75, **TD No. 384 (October 2000)**.

2000

F. DRUDI and A. PRATI, *Signaling fiscal regime sustainability,* European Economic Review, Vol. 44 (10), pp. 1897-1930, **TD No. 335 (September 1998)**.

F. FORNARI and R. VIOLI, *The probability density function of interest rates implied in the price of options,* in: R. Violi, (ed.) , Mercati dei derivati, controllo monetario e stabilità finanziaria, Il Mulino, Bologna. **TD No. 339 (October 1998)**.

D. J. MARCHETTI and G. PARIGI, *Energy consumption, survey data and the prediction of industrial production in Italy,* Journal of Forecasting, Vol. 19 (5), pp. 419-440, **TD No. 342 (December 1998)**.

A. BAFFIGI, M. PAGNINI and F. QUINTILIANI, *Localismo bancario e distretti industriali: assetto dei mercati del credito e finanziamento degli investimenti,* in: L.F. Signorini (ed.), Lo sviluppo locale: un'indagine della Banca d'Italia sui distretti industriali, Donzelli , **TD No. 347** (**March 1999)**.

A. SCALIA and V. VACCA, *Does market transparency matter? A case study*, in: Market Liquidity: Research Findings and Selected Policy Implications, Basel, Bank for International Settlements, **TD No. 359 (October 1999)**.

F. SCHIVARDI, *Rigidità nel mercato del lavoro, disoccupazione e crescita,* Giornale degli economisti e Annali di economia, Vol. 59 (1), pp. 117-143, **TD No. 364 (December 1999)**.

G. BODO, R. GOLINELLI and G. PARIGI, *Forecasting industrial production in the euro area,* Empirical Economics, Vol. 25 (4), pp. 541-561, **TD No. 370 (March 2000)**.

F. ALTISSIMO, D. J. MARCHETTI and G. P. ONETO, *The Italian business cycle: Coincident and leading indicators and some stylized facts,* Giornale degli economisti e Annali di economia, Vol. 60 (2), pp. 147-220, **TD No. 377 (October 2000)**.

C. MICHELACCI and P. ZAFFARONI, *(Fractional) Beta convergence*, Journal of Monetary Economics, Vol. 45, pp. 129-153, **TD No. 383 (October 2000)**.

R. DE BONIS and A. FERRANDO, *The Italian banking structure in the nineties: testing the multimarket contact hypothesis*, Economic Notes, Vol. 29 (2), pp. 215-241, **TD No. 387 (October 2000)**.

2001

M. CARUSO, *Stock prices and money velocity: A multi-country analysis,* Empirical Economics, Vol. 26 (4), pp. 651-72, **TD No. 264 (February 1996)**.

P. CIPOLLONE and D. J. MARCHETTI, *Bottlenecks and limits to growth: A multisectoral analysis of Italian industry*, Journal of Policy Modeling, Vol. 23 (6), pp. 601-620, **TD No. 314 (August 1997)**.

P. CASELLI, *Fiscal consolidations under fixed exchange rates,* European Economic Review, Vol. 45 (3), pp. 425-450, **TD No. 336 (October 1998)**.

F. ALTISSIMO and G. L. VIOLANTE, *Nonlinear VAR: Some theory and an application to US GNP and unemployment,* Journal of Applied Econometrics, Vol. 16 (4), pp. 461-486, **TD No. 338 (October 1998)**.

F. NUCCI and A. F. POZZOLO, *Investment and the exchange rate*, European Economic Review, Vol. 45 (2), pp. 259-283, **TD No. 344 (December 1998)**.

L. GAMBACORTA, *On the institutional design of the European monetary union: Conservatism, stability pact and economic shocks,* Economic Notes, Vol. 30 (1), pp. 109-143, **TD No. 356 (June 1999)**.

P. FINALDI RUSSO and P. ROSSI, *Credit costraints in italian industrial districts,* Applied Economics, Vol. 33 (11), pp. 1469-1477, **TD No. 360 (December 1999)**.

A. CUKIERMAN and F. LIPPI, *Labor markets and monetary union: A strategic analysis,* Economic Journal, Vol. 111 (473), pp. 541-565, **TD No. 365 (February 2000)**.

G. PARIGI and S. SIVIERO, *An investment-function-based measure of capacity utilisation, potential output and utilised capacity in the Bank of Italy's quarterly model*, Economic Modelling, Vol. 18 (4), pp. 525-550, **TD No. 367 (February 2000)**.

P. CASELLI, P. PAGANO and F. SCHIVARDI, *Investment and growth in Europe and in the United States in the nineties* Rivista di Politica Economica, Vol. 91 (10), pp. 3-35, **TD No. 372 (March 2000)**.

F. BALASSONE and D. MONACELLI, *Emu fiscal rules: Is there a gap?,* in: M. Bordignon and D. Da Empoli (eds.), Politica fiscale, flessibilità dei mercati e crescita*,* Milano*,* Franco Angeli, **TD No. 375 (July 2000)**.

A. B. ATKINSON and A. BRANDOLINI, *Promise and pitfalls in the use of "secondary" data-sets: Income inequality in OECD countries*, Journal of Economic Literature, Vol. 39 (3), pp. 771-799, **TD No. 379 (October 2000)**.

D. FOCARELLI and A. F. POZZOLO, *The determinants of cross-border bank shareholdings: An analysis with bank-level data from OECD countries*, Journal of Banking and Finance, Vol. 25 (12), pp. 2305-2337, **TD No. 381 (October 2000)**.

M. SBRACIA and A. ZAGHINI, *Expectations and information in second generation currency crises models*, Economic Modelling, Vol. 18 (2), pp. 203-222, **TD No. 391 (December 2000)**.

F. FORNARI and A. MELE, *Recovering the probability density function of asset prices using GARCH as diffusion approximations,* Journal of Empirical Finance, Vol. 8 (1), pp. 83-110**, TD No. 396 (February 2001)**.

P. CIPOLLONE, *La convergenza dei salari manifatturieri in Europa,* Politica economica, Vol. 17 (1), pp. 97-125, **TD No. 398 (February 2001)**.

E. BONACCORSI DI PATTI and G. GOBBI, *The changing structure of local credit markets: Are small businesses special?*, Journal of Banking and Finance, Vol. 25 (12), pp. 2209-2237, **TD No. 404 (June 2001)**.

G. MESSINA, *Decentramento fiscale e perequazione regionale. Efficienza e redistribuzione nel nuovo sistema di finanziamento delle regioni a statuto ordinario*, Studi economici, Vol. 56 (73), pp. 131-148, **TD No. 416 (August 2001)**.

2002

R. CESARI and F. PANETTA, *Style, fees and performance of Italian equity funds*, Journal of Banking and Finance, Vol. 26 (1), **TD No. 325 (January 1998)**.

C. GIANNINI, *"Enemy of none but a common friend of all"? An international perspective on the lender-of-last-resort function*, Essay in International Finance, Vol. 214, Princeton, N. J., Princeton University Press, **TD No. 341 (December 1998)**.

A. ZAGHINI, *Fiscal adjustments and economic performing: A comparative study*, Applied Economics, Vol. 33 (5), pp. 613-624, **TD No. 355 (June 1999)**.

F. FORNARI, C. MONTICELLI, M. PERICOLI and M. TIVEGNA, *The impact of news on the exchange rate of the lira and long-term interest rates,* Economic Modelling, Vol. 19 (4), pp. 611-639, **TD No. 358 (October 1999**).

D. FOCARELLI, F. PANETTA and C. SALLEO, *Why do banks merge?,* Journal of Money, Credit and Banking, Vol. 34 (4), pp. 1047-1066, **TD No. 361 (December 1999)**.

D. J. MARCHETTI, *Markup and the business cycle: Evidence from Italian manufacturing branches,* Open Economies Review, Vol. 13 (1), pp. 87-103, **TD No. 362 (December 1999**).

F. BUSETTI, *Testing for stochastic trends in series with structural breaks*, Journal of Forecasting, Vol. 21 (2), pp. 81-105, **TD No. 385 (October 2000)**.

F. LIPPI, *Revisiting the Case for a Populist Central Banker,* European Economic Review*,* Vol. 46 (3), pp. 601-612, **TD No. 386 (October 2000)**.

F. PANETTA, *The stability of the relation between the stock market and macroeconomic forces*, Economic Notes, Vol. 31 (3), **TD No. 393 (February 2001).**

G. GRANDE and L. VENTURA, *Labor income and risky assets under market incompleteness: Evidence from Italian data,* Journal of Banking and Finance, Vol. 26 (2-3), pp. 597-620, **TD No. 399 (March 2001)**.

A. BRANDOLINI, P. CIPOLLONE and P. SESTITO, *Earnings dispersion, low pay and household poverty in Italy, 1977-1998,* in D. Cohen, T. Piketty and G. Saint-Paul (eds.), The Economics of Rising Inequalities, pp. 225-264, Oxford, Oxford University Press, **TD No. 427 (November 2001)**.

FORTHCOMING

L. GAMBACORTA, *Asymmetric bank lending channels and ECB monetary policy*, Economic Modelling, pp. 25-46, **TD No. 340 (October 1998)**.

F. SCHIVARDI, *Reallocation and learning over the business cycle,* European Economic Review, **TD No. 345 (December 1998)**.

F. ALTISSIMO, S. SIVIERO and D. TERLIZZESE, *How deep are the deep parameters?,* Annales d'Economie et de Statistique, **TD No. 354 (June 1999)**.

P. CASELLI, P. PAGANO and F. SCHIVARDI, *Uncertainty and slowdown of capital accumulation in Europe,* Applied Economics, **TD No. 372 (March 2000).**

F. LIPPI, *Strategic monetary policy with non-atomistic wage-setters,* Review of Economic Studies, **TD No. 374 (June 2000)**.

P. ANGELINI and N. CETORELLI, *Bank competition and regulatory reform: The case of the Italian banking industry,* Journal of Money, Credit and Banking, **TD No. 380 (October 2000)**.

P. CHIADES and L. GAMBACORTA, *The Bernanke and Blinder model in an open economy: The Italian case,* German Economic Review, **TD No. 388 (December 2000)**.

P. PAGANO and F. SCHIVARDI, *Firm size distribution and growth,* Scandinavian Journal of Economics, **TD. No. 394 (February 2001)**.

M. PERICOLI and M. SBRACIA, *A Primer on Financial Contagion,* Journal of Economic Surveys, **TD No. 407 (June 2001)**.

M. SBRACIA and A. ZAGHINI, *The role of the banking system in the international transmission of shocks,* World Economy, **TD No. 409 (June 2001)**.

E. GAIOTTI and A. GENERALE, *Does monetary policy have asymmetric effects A look at the investment decisions of Italian firms,* Giornale degli Economisti e Annali di Economia, **TD No. 429 (December 2001)**.

L. GAMBACORTA, *The Italian banking system and monetary policy transmission: Evidence from bank level* *data*, in: I. Angeloni, A. Kashyap and B. Mojon (eds.), Monetary Policy Transmission in the Euro Area, Cambridge, Cambridge University Press, **TD No. 430 (December 2001)**

M. EHRMANN, L. GAMBACORTA, J. MARTÍNEZ PAGÉS, P. SEVESTRE e A. WORMS, *Financial systems and the role of banks in monetary policy transmission in the euro area,* in: I. Angeloni, A. Kashyap and B. Mojon (eds.), Monetary Policy Transmission in the Euro Area, Cambridge, Cambridge University Press. **TD No. 432 (December 2001)**.

D. FOCARELLI, *Bootstrap bias-correction procedure in estimating long-run relationships from dynamic panels, with an application to money demand in the euro area,* Economic Modelling, **TD No. 440 (March 2002)**.

D. FOCARELLI and F. PANETTA, *Are mergers beneficial to consumers? Evidence from the market for bank deposits*, American Economic Review, **TD No. 448 (July 2002)**.